The paragraph beginning at page 36, line 15 is amended as follows:

The computer model is a one-dimensional, explicit, finite-difference algorithm based on a conservation of mass equation, a Navier-Stokes momentum equation, and an equation of state releating local pressure to local size of artery applied at each vessel segment [Kufahl & Clark, *ASME J. of Biomech. Eng.* **107**:112-122 (1985)]. <u>Microfiche</u> Appendix B is a copy of the current computer model program. FIG. 29 is a flow chart of the modeling program.

The paragraph beginning at page 36, line 18 is amended as follows:

Since the arterial networks contain vessel loops (as well as many branchings), the pressure and flow nodes are staggered throughout the model. Each vessel is divided into many segments; the flow nodes are located at segment ends, the pressure nodes at segment centers. Any multi-vessel network configuration can be specified solely from the data file. <u>Microfiche</u> Appendix C is a sample data file with the computer parameters for a typical human model.

<u>IN THE CLAIMS</u>

Please replace claims 1, 5-6, 8-12, 15-17, 19-28, 52, and 55 with their respective claims in the appendix entitled "Clean Version of the Claims as Amended." All of the pending claims are listed in the appendix, whether or not amended. The replacement claims are intended to reflect the specific amendments as set forth below.

1. (amended) A method of modeling circulation in a living subject, such method comprising the steps of:

simulating the fluid dynamics of an arterial circulatory system;

[correcting] <u>adapting</u> the simulation to substantially conform to a specific arterial anatomy of the living subject;

forcing the simulation with [one or more flow parameters corresponding to a flow measurement obtained from the living subject; and,] <u>a forcing function made up of one or more flow-time or pressure-time signatures;</u>

calculating a flow of the circulatory system of the living subject based upon the [corrected and] forced simulation;

measuring a flow in the living subject corresponding to the calculated flow; and,

correcting the simulation based upon the calculated and measured flows.

2. The method of modeling as in claim 1 wherein the simulated circulatory system includes the Circle of Willis.

3. The method of modeling as in claim 1 further comprising the step of calculating a flow of the circulatory system based upon a selected blood flow perturbation.

4. The method of modeling as in claim 3 wherein the selected blood flow perturbation is a surgical alteration.

5. (amended) The method of modeling as in claim 1 wherein the step of [correcting] adapting the simulation to substantially conform to the living subject's anatomy further comprises conforming [selecting] a vessel of the [model and] simulation with a corresponding vessel in an image of the living subject.

6. (amended) The method of modeling as in claim 5 wherein the step of [correcting] adapting the simulation to substantially conform to the living subject's anatomy further comprises measuring a diameter of the corresponding vessel in the image of the living subject.

7. The method of modeling as in claim 6 further comprising localizing the corresponding vessel in three-dimensional space and tracing a boundary into adjacent areas in three-dimensional space to locate respective ends of the corresponding vessel.

---

8. (amended) The method of modeling as in claim [7] 1 [further comprising updating the simulation based upon the measured diameter and locations of the respective ends of corresponding vessel] wherein the step of correcting the simulation based upon the calculated and measured flows further comprises adjusting a flow resistance of the simulation based upon the ratio of the measured and calculated flows..

9. (amended) The method of modeling as in claim 8 wherein the [step of calculating a flow further comprises using] simulation of the circulatory system includes a one-dimensional, explicit, finite difference algorithm based upon a conservation of mass equation,a Navier-Stokes momentum equation, and an equation of state relating local pressure to local artery size .

10. (amended) The method of modeling as in claim [9] 1 [wherein the step of calculating a flow further comprises using a Navier-Stokes momentum equation] wherein the simulation is forced with a flow measurement obtained from the living subject.

11. (amended) The method of modeling as in claim [9] 1 [wherein the step of calculating a flow further comprises using an equation of state relating a local pressure to a local artery size] wherein the simulation is forced with a pressure-time signature obtained from a prototypical measurement.

12. (amended) Apparatus for modeling circulation within a living subject, such apparatus comprising:

a computerized simulation model of an arterial circulatory system, wherein the model calculates blood flows in the circulatory system when forced with a forcing function;

means for [correcting] adapting the model of the circulatory system to substantially conform to a specific arterial anatomy of the living subject;

means for measuring a blood flow in the circulatory system of the living subject;

[means for forcing the model with one or more flow parameters corresponding to a flow measurement obtained from the living subject; and,

means for calculating a flow and pressure of the circulatory system of the living subject based upon the corrected and forced model]

means for measuring a blood flow in the living subject corresponding to a flow calculated by the model; and,

means for correcting the model based upon the calculated and measured flows.

13. The apparatus for modeling as in claim 12 wherein the circulation model further comprises the Circle of Willis.

14. The apparatus for modeling as in claim 12 further comprising means for calculating a flow of the circulatory system based upon a selected blood flow perturbation.

15. (amended) The apparatus for modeling as in claim 12 wherein the means for measuring blood flow is a phase contrast magnetic resonance angiography flow measurement system.

16. (amended) The apparatus for modeling as in claim 15 wherein the means for [correcting] adapting the model to substantially conform to the living subject's anatomy further comprises means for selecting a vessel of the model and a corresponding vessel in an image of the living subject.

17. (amended) The apparatus for modeling as in claim 16 wherein the means for [correcting] adapting the model to substantially conform to the living subject's anatomy further comprises means for measuring a diameter of the corresponding vessel.

18. The apparatus for modeling as in claim 17 further comprising means for localizing the corresponding vessel in three-dimensional space and tracing a boundary into adjacent areas in three-dimensional space to locate respective ends of the corresponding vessel.

19. (amended) The apparatus for modeling as in claim [18] 12 [further comprising means for updating the model based upon the measured diameter and locations of the respective ends of the corresponding vessel] wherein the means for correcting the model adjusts a flow resistance based on a ratio of the measured and calculated flows.

20. (amended) The apparatus for modeling as in claim 12 wherein the [means for calculating the flow further comprises means using] computerized simulation model includes a one-dimensional, explicit, finite difference algorithm based upon a conservation of mass equation, a Navier-Stokes momentum equation, and an equation of state relating local pressure to local artery size.

21. (amended) The apparatus for modeling as in claim [20] 12 [wherein the means for calculating the flow further comprises means using a Navier-Stokes momentum equation] wherein the model is forced with a flow measurement obtained from the living subject.

22. (amended) The apparatus for modeling as in claim [21] 12 [wherein the means for calculating the flow comprises means using an equation of state relating a local pressure to a local artery size] wherein the model is forced with a pressure-time signature obtained from a prototypical measurement.

23. (amended) A system for modeling circulation in a living subject, comprising:

a computerized fluid dynamics simulation model of an arterial circulatory system[;] which includes [a correction processor adapted to correct the model of the circulatory system] an adaptation module for adapting the model to substantially conform to a specific arterial anatomy of the living subject;

a blood flow measurement device for obtaining a flow measurement from the living subject [so that the model may be forced with one or more flow parameters corresponding thereto]; and

[a flow processor adapted to calculate a flow and pressure of the circulatory system of the living subject based upon the corrected and forced model]

wherein the model includes a correction module for correcting the model based on the measured flow and a corresponding flow calculated by the model.

24. (amended) The system for modeling as in claim 23 wherein the [circulation] simulation model includes the Circle of Willis.

25. (amended) The system for modeling as in claim 23 [wherein the correction processor further comprises] further comprising:

an imaging device for generating an image of the circulatory system of the living subject;

a display device for displaying the generated image of the circulatory system, the display device including a cursor adapted to select a vessel of the [model] image, and,

wherein the selected vessel is input to the adaptation module in order to adapt the model to substantially conform to a specific arterial anatomy of the living subject.

26. (amended) The system for modeling as in claim 25 [wherein the correction processor further comprises a pixel processor adapted to process] further comprising a pixel processing module for processing pixel data from the imaging device of the general area of the [corresponding] selected vessel to locate a boundary [area] between the [corresponding] selected vessel and surrounding tissue.

27. (amended) The system for modeling as in claim 26 wherein the pixel [processor] processing module [further comprises a distance processor adapted to] measures a diameter of the corresponding vessel.

28. (amended) The system for modeling as in claim 27 wherein the pixel [processor] processing module [further comprises a tracing processor adapted to] traces the boundary of the selected vessel into adjacent areas in three-dimensional space to locate respective ends of the corresponding vessel.